SOLENOID VALVE FOR FUEL INJECTION DEVICE

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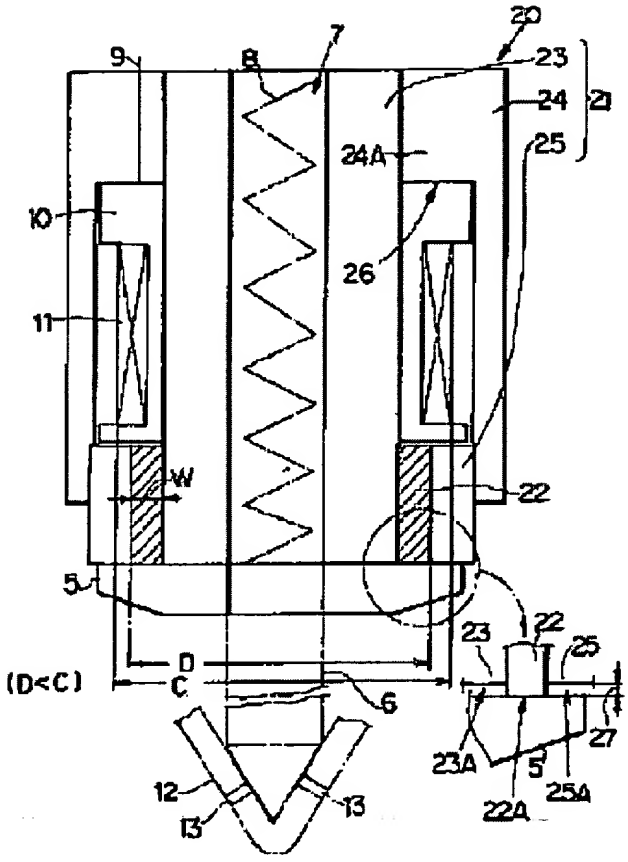
Abstract of **JP11044275**

PROBLEM TO BE SOLVED: To obtain a solenoid valve for a fuel injection device to generate the high attraction force of an electromagnetic coil providing a magnetic path area and to cope with a demand for improvement of responsiveness at the same outline size and the increase of an operable fuel pressure. SOLUTION: Since it is noticed that a seal member 22 contracts a magnetic passage area between an electromagnetic coil 11 and an armature 5 and by enlarging the magnetic path area, a necessary suction force is generated even by the same magnetomotive force. An electromagnetic coil 11 and a seal member 22 formed of a non-magnetic substance are arranged in an annually formed opening space part 26 at one end of the armature 5 side in the axial direction of inner and outer core parts 23, 24 and 25, being a core part 21, to close an opening space part 26. Further, the outside diameter D of the seal member 22 is reduced to a value lower than the outside diameter C of an electromagnetic coil.



JAPANESE [JP,11-044275,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] the electromagnetism which can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting said core section from the inside core section and the outside core section Carry out opening of the end by the side of said armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- said electromagnetism -- the seal member which prepared the coil and was further constituted from non-magnetic material -- preparing -- this opening space section -- being closed down -- the outer diameter of the seal member of a parenthesis -- said electromagnetism -- the solenoid valve for fuel injection equipments characterized by making this smaller than the outer diameter of a coil.
[Claim 2] the electromagnetism which can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting said core section from the inside core section and the outside core section Carry out opening of the end by the side of said armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- said electromagnetism -- by preparing a coil, preparing the seal member constituted from non-magnetic material in the inner circumference side of this opening space section, and locating said outside core section in the periphery side of this opening space section further The solenoid valve for fuel injection equipments characterized by closing this opening space section.
[Claim 3] They are claim 1 which said inside core section and said outside core section constitute this from an another member mutually, and this inside core section makes this a hollow cylinder configuration, and is characterized by this outside core section making this the hollow cylinder configuration which has the level difference which can form said opening space section in that inner skin, or a solenoid valve for fuel injection equipments given in two.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention starts the solenoid valve for fuel injection equipments, and relates to the solenoid valve for fuel injection equipments which can set up especially a suction force greatly.
[0002]
[Description of the Prior Art] When a big suction force is required for the solenoid of the solenoid valve used for fuel injection equipments, such as the conventional object for gasoline inlet-pipe injection, or an electromagnetic injector for the direct injection in a high-pressure cylinder, generally the solenoid of a disk mold which can set up suction area greatly from the solenoid of a plunger type is used. That is, since the solenoid of a disk mold can set up the suction area greatly in the same outer diameter, it is possible to take a large generating suction force. Therefore, in the state of high responsibility or high fuel pressure, when actuation is required, it is used comparatively easily. For example, there are JP,8-189437,A, JP,8-210217,A, etc. However, there is a problem that a limit is in the suction force which can also obtain this disk type of solenoid in the limited tooth space.
[0003] Based on drawing 3 , it outlines about the conventional solenoid valve 1 for fuel injection equipments. drawing 3 -- drawing of longitudinal section of the solenoid valve 1 for fuel injection equipments -- it is -- the solenoid valve 1 for fuel injection equipments -- the core section 2 and electromagnetism -- it has a coil 3, the seal member 4, the armature 5 of a disk mold, and a needle valve 6.
[0004] the core section 2 -- this -- from the magnetic substance -- constituting -- electromagnetism -- while surrounding a bore [of a coil 3], and outer-diameter side, letting magnetic flux pass and making the center section into the fuel path 7, installation of a return spring 8 is enabled.
[0005] electromagnetism -- a coil 3 has the bobbin 10 which attached the terminal 9 for energization, and the coil 11 made to generate magnetomotive force by energization, and can form a magnetic circuit in the core section 2.
[0006] the seal member 4 constituting this from non-magnetic material, and intercepting the magnetic path by the side of the inner circumference of the core section 2, and a periphery -- the magnetic path between the core section 2 and an armature 5 -- securing -- the electromagnetism from the fuel path 7 side -- a seal is carried out so that a fuel may not invade into a coil 3 side.
[0007] an armature 5 -- this -- from the magnetic substance -- constituting -- between the core sections 2 -- a magnetic circuit -- forming -- electromagnetism -- it can stick to a coil 3 (core section 2).
[0008] A needle valve 6 enables injection of a direct fuel in an inlet pipe or a cylinder from the nozzle 13 of a valve seat 12 while attaching it in an armature 5.
[0009] in addition -- if it hits assembling the solenoid valve 1 for fuel injection equipments -- the electromagnetism from an armature 5 side (drawing Nakashita side) -- a coil 3 is inserted in the core section 2, and full circled welding is performed further after pressing the seal member 4 fit in the core section 2.
[0010] the solenoid valve 1 for fuel injection equipments of such a configuration -- setting -- electromagnetism -- the suction force F which attracts the armature 5 at the time of excitation of a coil 3 -- 2/(micro-S-nu) of F=phi -- since -- it asks. However, for phi, the amount of magnetic flux (wb) and mu are [the area of the suction section (part except the seal member 4 which the core section 2 counters with an armature 5), and nu of permeability and S] leakage coefficients.
[0011] That is, the suction force F of the solenoid valve 1 for fuel injection equipments is determined by the amount phi of magnetic flux. Generally, since, as for the magnetic material, the saturation magnetic flux density was decided, the maximum of the amount phi of magnetic flux is proportional to the magnetic-path cross section. Although the direction which enlarged the magnetic-path cross section can enlarge a suction force F in short Since the seal member 4

has fastened greatly the magnetic-path cross-section part with the armature 5 of the core section 2 which counters, namely, the part of this seal member 4 -- electromagnetism, since it has not contributed to the suction effect of the armature 5 with a coil 3 The usable suction force F and magnetic-path area are restricted, and so large the magnetic-path cross section cannot be taken in the conventional solenoid valve 1 for fuel injection equipments, but there is a problem that it is difficult to enlarge a suction force F. Therefore, there is a problem that it cannot respond as a solenoid valve 1 for fuel injection equipments when an improvement of the further responsibility and the increment in the fuel pressure which can be operated are required while the core section 2 has been the same outer-diameter dimension.
[0012] such a problem becoming high-pressure-izing of fuel injection pressure, and the request of improvement in responsibility with a failure, and enlarging a suction force F with the same outer diameter, or smaller electromagnetism -- a coil 3 -- the need -- it is requested that sufficient suction force F should be generated etc.
[0013]
[Problem(s) to be Solved by the Invention] This invention was made in view of many above problems, and let it be a technical problem to offer the solenoid valve for fuel injection equipments which can acquire a bigger suction force than before.
[0014] Moreover, this invention makes it a technical problem to offer the solenoid valve for fuel injection equipments which can obtain a bigger magnetic-path area than before.
[0015] Moreover, this invention makes it a technical problem to offer the large solenoid valve for fuel injection equipments which can be set up for a suction force, without increasing an outer-diameter dimension.
[0016] Moreover, this invention makes it a technical problem to offer the solenoid valve for fuel injection equipments which can respond to an improvement of responsibility or the request of an increment of the fuel pressure which can be operated with the same outer-diameter dimension.
[0017] moreover, this invention -- the same tooth space as the former -- setting -- electromagnetism -- the suction force of a coil is increased and let it be a technical problem to offer the solenoid valve for fuel injection equipments which can realize high responsibility and good actuation nature in a high fuel pressure condition.
[0018]
[Means for Solving the Problem] It is what noted that the need was able to acquire a suction force also with the same magnetomotive force if reducing the magnetic-path area between a coil and an armature and the magnetic-path area of this part are expanded. namely, this invention -- a seal member -- electromagnetism -- the electromagnetism by which the first invention can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting the above-mentioned core section from the inside core section and the outside core section Carry out opening of the end by the side of the above-mentioned armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- the above -- electromagnetism -- the seal member which prepared the coil and was further constituted from non-magnetic material -- preparing -- this opening space section -- being closed down -- the outer diameter of the seal member of a parenthesis -- the above -- electromagnetism -- it is the solenoid valve for fuel injection equipments characterized by making this smaller than the outer diameter of a coil.
[0019] the electromagnetism by which the second invention can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting the above-mentioned core section from the inside core section and the outside core section Carry out opening of the end by the side of the above-mentioned armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- the above -- electromagnetism -- by preparing a coil, preparing the seal member constituted from non-magnetic material in the inner circumference side of this opening space section, and locating the above-mentioned outside core section in the periphery side of this opening space section further It is the solenoid valve for fuel injection equipments characterized by closing this opening space section.
[0020] The above-mentioned inside core section and the above-mentioned outside core section can constitute this from an another member mutually, this inside core section can make this a hollow cylinder configuration, and this outside core section can make this the hollow cylinder configuration which has the level difference which can form the above-mentioned opening space section in that inner skin.
[0021] The resilient tongue for raising the seal engine performance can be formed in the above-mentioned seal member.

[0022] Furthermore, about the division gestalt for dividing and constituting the core section in the inside core section and the outside core section, if an assembly is possible as a solenoid valve and the cross section of the seal member of non-magnetic material can be made small, the configuration of arbitration is employable.
[0023] the solenoid valve for fuel injection equipments by this invention -- setting -- a seal member -- electromagnetism -- since a magnetic path is secured and it was made to make small the cross-sectional area of this seal member, while preventing fuel invasion into the part of a coil -- electromagnetism -- it is possible only for that part to enlarge magnetic-path area between a coil and an armature -- becoming -- electromagnetism -- the suction force of an armature with a coil can be enlarged.
[0024] therefore -- as the solenoid valve for fuel injection equipments -- the same outer diameter -- it is -- electromagnetism -- while being able to enlarge the suction force of a coil -- the need -- in order to acquire sufficient suction force -- electromagnetism -- the number of turns of the current energized in a coil or a coil is reduced, and a pressure-up value and the rate of rise are increased -- making -- electromagnetism -- the miniaturization of the coil itself is possible. that is, since the same suction force is generated by making magnetic-path area into size, flux density is fallen -- it can make -- the part -- electromagnetism -- a coil can be miniaturized.
[0025] the first invention -- the outer diameter of a seal member -- electromagnetism -- since it was made smaller than the outer diameter of a coil -- electromagnetism -- between a coil and armatures -- magnetic flux -- many -- it can generate -- electromagnetism -- the suction force of an armature with a coil can be increased.
[0026] Furthermore, since the core section has been arranged from the seal member to the periphery side, magnetic flux can pass by second invention also in this core section, and an armature can be attracted with a bigger suction force by it.
[0027] Moreover, since the area of a suction part serves as a square of a path, the magnetic-path cross-sectional area can be made to increase more effectively, if the thickness of a seal member is set up small and the magnetic-path cross-sectional area of the inside and an outside is arranged with sufficient balance. However, since the leakage of the magnetic flux which does not act on suction also increases, an optimum value exists in the thickness of a seal member.
[0028]
[Embodiment of the Invention] Below, the solenoid valve 20 for fuel injection equipments by the gestalt of operation of the 1st of this invention is explained based on drawing 1 . However, the same sign is given to the same part as drawing 3 , and the detailed explanation omits this. drawing 1 -- drawing of longitudinal section of the solenoid valve 20 for fuel injection equipments -- it is -- the solenoid valve 20 for fuel injection equipments -- said electromagnetism -- it has the core section 21 which is equivalent to the core section 2 with a coil 3, an armature 5, and a needle valve 6, and the seal member 22 equivalent to the seal member 4. The core section 21 has the inside core section 23, the 1st outside core section 24, and the 2nd outside core section 25 which were made into the hollow cylinder configuration, respectively. Although the inside core section 23, the 1st outside core section 24, and the 2nd outside core section 25 are another objects mutually, they constitute these [both] from the magnetic substance, and let magnetic flux pass.
[0029] the seal member 22 -- this -- from non-magnetic material -- constituting -- the 2nd outside core section 25 -- electromagnetism -- the bobbin 10 of a coil 3 is supported.
[0030] namely, the end which the 1st outside core section 24 has step 24A, and countered the armature 5 side of the opposite side with this step 24A between the inside core section 23 and the 1st outside core section 24 -- the shape of a ring -- the opening space section 26 -- opening formation -- carrying out -- this opening space section 26 -- electromagnetism -- a coil 3 -- the seal member 22 and the 2nd outside core section 25 are formed further. If it puts in another way, the seal member 22 of the shape of a cylinder which has the bigger outer diameter D than the inside core section 23 is formed in the armature 5 side-edge side of the core section 21 (the inside core section 23, the 1st outside core section 24, and 2nd outside core section 25), and the 2nd outside core section 25 of a ferromagnetic is further located in the outside. however, the outer diameter D of the seal member 22 -- electromagnetism -- it is made smaller than the outer diameter C of a coil 3. These three members are made by one by projection welding, press fit welding, etc.
[0031] So that an important section may be expanded and shown in addition, lower limit side 22A by the side of the armature 5 of the seal member 22 Make it project to an armature 5 side more slightly than lower limit side 23A of the inside core section 23, and lower limit side 25A of the 2nd outside core section 25, and the slight opening section 27 is formed. lower limit side 22A of the seal member 22 which is non-magnetic material when an armature 5 is attracted and a lift is carried out to the method of drawing Nakagami -- an armature 5 -- contacting -- electromagnetism -- the armature 5 is easily made movable to the method of drawing Nakashita according to the energization force of a return spring 8 at the time of demagnetization of a coil 3.
[0032] moreover -- if it hits assembling the solenoid valve 20 for fuel injection equipments -- the seal member 22, the

inside core section 23, and the 2nd outside core section 25 -- one -- a condition -- carrying out -- the inside core section 23 -- electromagnetism -- a coil 3 is inserted from a drawing Nakagami side. Furthermore, the 1st outside core section 24 is inserted from the bottom, and after pressing fit in the inside core section 23, full circled welding is performed and it fixes.

[0033] Since the cross section of a magnetic path and the suction section (the 2nd outside core section 25 and inside core section 23) can be greatly set up though the whole is the same outer-diameter dimension so that the thickness W of the seal member 22 is small, the suction force can be made to increase in the solenoid valve 20 for fuel injection equipments of such a configuration.

[0034] R= 1/(micro-S) of magnetic-path resistance R of said opening section 27 comes out, and it is expressed. If the cross section S of this suction section is large, since this magnetic-path resistance R will be small and the flux density of the core section 21 will fall further, the magnetomotive force for acquiring the same suction force F may be reduced. that is, the thing which, as for a suction force F increasing, a pressure-up value decreases -- it is -- electromagnetism -- the current value passed in the coil 11 of a coil 3 or its number of turns can be reduced.

[0035] Drawing 2 is drawing of longitudinal section showing the example which built the solenoid valve for fuel injection equipments by the gestalt of operation of the 2nd of this invention into the actual fuel injection equipment 30, and a fuel injection equipment 30 has a connector 32, the upper part bulb housing 33 (equivalent to the 1st outside core section 24), the lower part bulb housing 34, the pipe 35 for fuel supply, a spring seat 36, and said valve seat 12 with this solenoid valve 31 for fuel injection equipments.

[0036] the solenoid valve 31 for fuel injection equipments -- the core section 21 (the inside core section 23, the 1st outside core section 24, 2nd outside core section 25) and electromagnetism -- it has the seal member 37 which is equivalent to the seal member 4 with the armature 5 and needle valve 6 of a coil 3 and a disk mold. the pressure-welding section radial [between the 2nd outside core section 25] so that this seal member 37 may expand and show an important section -- the 1st resilient tongue 38 and electromagnetism -- the 2nd resilient tongue 39 is formed in the pressure-welding section of the shaft orientations between the bobbins 10 of a coil 3, and the seal engine performance of a fuel is raised.

[0037] since the radial cross-sectional area of the seal member 37 was made small also in the fuel injection equipment 30 equipped with the solenoid valve 31 for fuel injection equipments of such a configuration like the solenoid valve 20 for fuel injection equipments explained based on drawing 1 while the seal member 37 performed the seal of a fuel -- the part -- electromagnetism -- the magnetic-path area formed between a coil 3 and an armature 5 -- expanding -- electromagnetism -- the suction force of a coil 3 can be made to ******

[0038]

[Effect of the Invention] since magnitude of a seal member was made small as mentioned above according to this invention -- the same tooth space -- electromagnetism -- the suction force of a coil can be made to increase Moreover, since the magnetic-path cross section becomes large, the magnetomotive force at the time of the same suction force can be reduced. Furthermore, since the set force of a return spring can be enlarged with an improvement of the responsibility as a fuel injection equipment, and the rise of operating fuel pressure, it becomes possible to raise the engine performance -- the metering range of the injection quantity can be increased. In addition, if fuel pressure can be set up greatly, the atomization of spraying can be promoted and engine combustion and an engine exhaust air property can also be improved again.

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TECHNICAL FIELD

[Field of the Invention] This invention starts the solenoid valve for fuel injection equipments, and relates to the solenoid valve for fuel injection equipments which can set up especially a suction force greatly.

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PRIOR ART

[Description of the Prior Art] When a big suction force is required for the solenoid of the solenoid valve used for fuel injection equipments, such as the conventional object for gasoline inlet-pipe injection, or an electromagnetic injector for the direct injection in a high-pressure cylinder, generally the solenoid of a disk mold which can set up suction area greatly from the solenoid of a plunger type is used. That is, since the solenoid of a disk mold can set up the suction area greatly in the same outer diameter, it is possible to take a large generating suction force. Therefore, in the state of high responsibility or high fuel pressure, when actuation is required, it is used comparatively easily. For example, there are JP,8-189437,A, JP,8-210217,A, etc. However, there is a problem that a limit is in the suction force which can also obtain this disk type of solenoid in the limited tooth space.
[0003] Based on drawing 3 , it outlines about the conventional solenoid valve 1 for fuel injection equipments. drawing 3 -- drawing of longitudinal section of the solenoid valve 1 for fuel injection equipments -- it is -- the solenoid valve 1 for fuel injection equipments -- the core section 2 and electromagnetism -- it has a coil 3, the seal member 4, the armature 5 of a disk mold, and a needle valve 6.
[0004] the core section 2 -- this -- from the magnetic substance -- constituting -- electromagnetism -- while surrounding a bore [of a coil 3], and outer-diameter side, letting magnetic flux pass and making the center section into the fuel path 7, installation of a return spring 8 is enabled.
[0005] electromagnetism -- a coil 3 has the bobbin 10 which attached the terminal 9 for energization, and the coil 11 made to generate magnetomotive force by energization, and can form a magnetic circuit in the core section 2.
[0006] the seal member 4 constituting this from non-magnetic material, and intercepting the magnetic path by the side of the inner circumference of the core section 2, and a periphery -- the magnetic path between the core section 2 and an armature 5 -- securing -- the electromagnetism from the fuel path 7 side -- a seal is carried out so that a fuel may not invade into a coil 3 side.
[0007] an armature 5 -- this -- from the magnetic substance -- constituting -- between the core sections 2 -- a magnetic circuit -- forming -- electromagnetism -- it can stick to a coil 3 (core section 2).
[0008] A needle valve 6 enables injection of a direct fuel in an inlet pipe or a cylinder from the nozzle 13 of a valve seat 12 while attaching it in an armature 5.
[0009] in addition -- if it hits assembling the solenoid valve 1 for fuel injection equipments -- the electromagnetism from an armature 5 side (drawing Nakashita side) -- a coil 3 is inserted in the core section 2, and full circled welding is performed further after pressing the seal member 4 fit in the core section 2.
[0010] the solenoid valve 1 for fuel injection equipments of such a configuration -- setting -- electromagnetism -- the suction force F which attracts the armature 5 at the time of excitation of a coil 3 -- 2/(micro-S-nu) of F=phi -- since -- it asks. However, for phi, the amount of magnetic flux (wb) and mu are [the area of the suction section (part except the seal member 4 which the core section 2 counters with an armature 5), and nu of permeability and S] leakage coefficients.
[0011] That is, the suction force F of the solenoid valve 1 for fuel injection equipments is determined by the amount phi of magnetic flux. Generally, since, as for the magnetic material, the saturation magnetic flux density was decided, the maximum of the amount phi of magnetic flux is proportional to the magnetic-path cross section. Although the direction which enlarged the magnetic-path cross section can enlarge a suction force F in short Since the seal member 4 has fastened greatly the magnetic-path cross-section part with the armature 5 of the core section 2 which counters, namely, the part of this seal member 4 -- electromagnetism, since it has not contributed to the suction effect of the armature 5 with a coil 3 The usable suction force F and magnetic-path area are restricted, and so large the magnetic-path cross section cannot be taken in the conventional solenoid valve 1 for fuel injection equipments, but there is a problem that it is difficult to enlarge a suction force F. Therefore, there is a problem that it cannot respond as a solenoid

valve 1 for fuel injection equipments when an improvement of the further responsibility and the increment in the fuel pressure which can be operated are required while the core section 2 has been the same outer-diameter dimension.
[0012] such a problem becoming high-pressure-izing of fuel injection pressure, and the request of improvement in responsibility with a failure, and enlarging a suction force F with the same outer diameter, or smaller electromagnetism -- a coil 3 -- the need -- it is requested that sufficient suction force F should be generated etc.

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EFFECT OF THE INVENTION

[Effect of the Invention] since magnitude of a seal member was made small as mentioned above according to this invention -- the same tooth space -- electromagnetism -- the suction force of a coil can be made to increase Moreover, since the magnetic-path cross section becomes large, the magnetomotive force at the time of the same suction force can be reduced. Furthermore, since the set force of a return spring can be enlarged with an improvement of the responsibility as a fuel injection equipment, and the rise of operating fuel pressure, it becomes possible to raise the engine performance -- the metering range of the injection quantity can be increased. In addition, if fuel pressure can be set up greatly, the atomization of spraying can be promoted and engine combustion and an engine exhaust air property can also be improved again.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention was made in view of many above problems, and let it be a technical problem to offer the solenoid valve for fuel injection equipments which can acquire a bigger suction force than before.
[0014] Moreover, this invention makes it a technical problem to offer the solenoid valve for fuel injection equipments which can obtain a bigger magnetic-path area than before.
[0015] Moreover, this invention makes it a technical problem to offer the large solenoid valve for fuel injection equipments which can be set up for a suction force, without increasing an outer-diameter dimension.
[0016] Moreover, this invention makes it a technical problem to offer the solenoid valve for fuel injection equipments which can respond to an improvement of responsibility or the request of an increment of the fuel pressure which can be operated with the same outer-diameter dimension.
[0017] moreover, this invention -- the same tooth space as the former -- setting -- electromagnetism -- the suction force of a coil is increased and let it be a technical problem to offer the solenoid valve for fuel injection equipments which can realize high responsibility and good actuation nature in a high fuel pressure condition.

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MEANS

[Means for Solving the Problem] It is what noted that the need was able to acquire a suction force also with the same magnetomotive force if reducing the magnetic-path area between a coil and an armature and the magnetic-path area of this part are expanded. namely, this invention -- a seal member -- electromagnetism -- the electromagnetism by which the first invention can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting the above-mentioned core section from the inside core section and the outside core section Carry out opening of the end by the side of the above-mentioned armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- the above -- electromagnetism -- the seal member which prepared the coil and was further constituted from non-magnetic material -- preparing -- this opening space section -- being closed down -- the outer diameter of the seal member of a parenthesis -- the above -- electromagnetism -- it is the solenoid valve for fuel injection equipments characterized by making this smaller than the outer diameter of a coil.
[0019] the electromagnetism by which the second invention can form a magnetic circuit in the core section constituted from the magnetic substance, and this core section, while attaching in a coil, the armature of the disk mold which can stick to this core section, and this armature While being the solenoid valve for fuel injection equipments which has the needle valve whose injection of a fuel is enabled from a nozzle and constituting the above-mentioned core section from the inside core section and the outside core section Carry out opening of the end by the side of the above-mentioned armature in the shaft orientations of these inside core section and the outside core section to the shape of a ring, and the opening space section is formed. this opening space section -- the above -- electromagnetism -- by preparing a coil, preparing the seal member constituted from non-magnetic material in the inner circumference side of this opening space section, and locating the above-mentioned outside core section in the periphery side of this opening space section further It is the solenoid valve for fuel injection equipments characterized by closing this opening space section.
[0020] The above-mentioned inside core section and the above-mentioned outside core section can constitute this from an another member mutually, this inside core section can make this a hollow cylinder configuration, and this outside core section can make this the hollow cylinder configuration which has the level difference which can form the above-mentioned opening space section in that inner skin.
[0021] The resilient tongue for raising the seal engine performance can be formed in the above-mentioned seal member.
[0022] Furthermore, about the division gestalt for dividing and constituting the core section in the inside core section and the outside core section, if an assembly is possible as a solenoid valve and the cross section of the seal member of non-magnetic material can be made small, the configuration of arbitration is employable.
[0023] the solenoid valve for fuel injection equipments by this invention -- setting -- a seal member -- electromagnetism -- since a magnetic path is secured and it was made to make small the cross-sectional area of this seal member, while preventing fuel invasion into the part of a coil -- electromagnetism -- it is possible only for that part to enlarge magnetic-path area between a coil and an armature -- becoming -- electromagnetism -- the suction force of an armature with a coil can be enlarged.
[0024] therefore -- as the solenoid valve for fuel injection equipments -- the same outer diameter -- it is -- electromagnetism -- while being able to enlarge the suction force of a coil -- the need -- in order to acquire sufficient suction force -- electromagnetism -- the number of turns of the current energized in a coil or a coil is reduced, and a pressure-up value and the rate of rise are increased -- making -- electromagnetism -- the miniaturization of the coil itself is possible. that is, since the same suction force is generated by making magnetic-path area into size, flux density

is fallen -- it can make -- the part -- electromagnetism -- a coil can be miniaturized.
[0025] the first invention -- the outer diameter of a seal member -- electromagnetism -- since it was made smaller than the outer diameter of a coil -- electromagnetism -- between a coil and armatures -- magnetic flux -- many -- it can generate -- electromagnetism -- the suction force of an armature with a coil can be increased.
[0026] Furthermore, since the core section has been arranged from the seal member to the periphery side, magnetic flux can pass by second invention also in this core section, and an armature can be attracted with a bigger suction force by it.
[0027] Moreover, since the area of a suction part serves as a square of a path, the magnetic-path cross-sectional area can be made to increase more effectively, if the thickness of a seal member is set up small and the magnetic-path cross-sectional area of the inside and an outside is arranged with sufficient balance. However, since the leakage of the magnetic flux which does not act on suction also increases, an optimum value exists in the thickness of a seal member.
[0028]
[Embodiment of the Invention] Below, the solenoid valve 20 for fuel injection equipments by the gestalt of operation of the 1st of this invention is explained based on drawing 1 . However, the same sign is given to the same part as drawing 3 , and the detailed explanation omits this. drawing 1 -- drawing of longitudinal section of the solenoid valve 20 for fuel injection equipments -- it is -- the solenoid valve 20 for fuel injection equipments -- said electromagnetism -- it has the core section 21 which is equivalent to the core section 2 with a coil 3, an armature 5, and a needle valve 6, and the seal member 22 equivalent to the seal member 4. The core section 21 has the inside core section 23, the 1st outside core section 24, and the 2nd outside core section 25 which were made into the hollow cylinder configuration, respectively. Although the inside core section 23, the 1st outside core section 24, and the 2nd outside core section 25 are another objects mutually, they constitute these [both] from the magnetic substance, and let magnetic flux pass.
[0029] the seal member 22 -- this -- from non-magnetic material -- constituting -- the 2nd outside core section 25 -- electromagnetism -- the bobbin 10 of a coil 3 is supported.
[0030] namely, the end which the 1st outside core section 24 has step 24A, and countered the armature 5 side of the opposite side with this step 24A between the inside core section 23 and the 1st outside core section 24 -- the shape of a ring -- the opening space section 26 -- opening formation -- carrying out -- this opening space section 26 -- electromagnetism -- a coil 3 -- the seal member 22 and the 2nd outside core section 25 are formed further. If it puts in another way, the seal member 22 of the shape of a cylinder which has the bigger outer diameter D than the inside core section 23 is formed in the armature 5 side-edge side of the core section 21 (the inside core section 23, the 1st outside core section 24, and 2nd outside core section 25), and the 2nd outside core section 25 of a ferromagnetic is further located in the outside. however, the outer diameter D of the seal member 22 -- electromagnetism -- it is made smaller than the outer diameter C of a coil 3. These three members are made by one by projection welding, press fit welding, etc.
[0031] So that an important section may be expanded and shown in addition, lower limit side 22A by the side of the armature 5 of the seal member 22 Make it project to an armature 5 side more slightly than lower limit side 23A of the inside core section 23, and lower limit side 25A of the 2nd outside core section 25, and the slight opening section 27 is formed. lower limit side 22A of the seal member 22 which is non-magnetic material when an armature 5 is attracted and a lift is carried out to the method of drawing Nakagami -- an armature 5 -- contacting -- electromagnetism -- the armature 5 is easily made movable to the method of drawing Nakashita according to the energization force of a return spring 8 at the time of demagnetization of a coil 3.
[0032] moreover -- if it hits assembling the solenoid valve 20 for fuel injection equipments -- the seal member 22, the inside core section 23, and the 2nd outside core section 25 -- one -- a condition -- carrying out -- the inside core section 23 -- electromagnetism -- a coil 3 is inserted from a drawing Nakagami side. Furthermore, the 1st outside core section 24 is inserted from the bottom, and after pressing fit in the inside core section 23, full circled welding is performed and it fixes.
[0033] Since the cross section of a magnetic path and the suction section (the 2nd outside core section 25 and inside core section 23) can be greatly set up though the whole is the same outer-diameter dimension so that the thickness W of the seal member 22 is small, the suction force can be made to increase in the solenoid valve 20 for fuel injection equipments of such a configuration.
[0034] R= 1/(micro-S) of magnetic-path resistance R of said opening section 27 comes out, and it is expressed. If the cross section S of this suction section is large, since this magnetic-path resistance R will be small and the flux density of the core section 21 will fall further, the magnetomotive force for acquiring the same suction force F may be reduced. that is, the thing which, as for a suction force F increasing, a pressure-up value decreases -- it is -- electromagnetism -- the current value passed in the coil 11 of a coil 3 or its number of turns can be reduced.

[0035] Drawing 2 is drawing of longitudinal section showing the example which built the solenoid valve for fuel injection equipments by the gestalt of operation of the 2nd of this invention into the actual fuel injection equipment 30, and a fuel injection equipment 30 has a connector 32, the upper part bulb housing 33 (equivalent to the 1st outside core section 24), the lower part bulb housing 34, the pipe 35 for fuel supply, a spring seat 36, and said valve seat 12 with this solenoid valve 31 for fuel injection equipments.

[0036] the solenoid valve 31 for fuel injection equipments -- the core section 21 (the inside core section 23, the 1st outside core section 24, 2nd outside core section 25) and electromagnetism -- it has the seal member 37 which is equivalent to the seal member 4 with the armature 5 and needle valve 6 of a coil 3 and a disk mold. the pressure-welding section radial [between the 2nd outside core section 25] so that this seal member 37 may expand and show an important section -- the 1st resilient tongue 38 and electromagnetism -- the 2nd resilient tongue 39 is formed in the pressure-welding section of the shaft orientations between the bobbins 10 of a coil 3, and the seal engine performance of a fuel is raised.

[0037] since the radial cross-sectional area of the seal member 37 was made small also in the fuel injection equipment 30 equipped with the solenoid valve 31 for fuel injection equipments of such a configuration like the solenoid valve 20 for fuel injection equipments explained based on drawing 1 while the seal member 37 performed the seal of a fuel -- the part -- electromagnetism -- the magnetic-path area formed between a coil 3 and an armature 5 -- expanding -- electromagnetism -- the suction force of a coil 3 can be made to ******

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section of the solenoid valve 20 for fuel injection equipments by the gestalt of operation of the 1st of this invention.
[Drawing 2] It is drawing of longitudinal section showing the example which built the solenoid valve 31 for fuel injection equipments by the gestalt of operation of the 2nd of this invention into the actual fuel injection equipment 30.
[Drawing 3] It is drawing of longitudinal section of the conventional solenoid valve 1 for fuel injection equipments.
[Description of Notations]
1 Solenoid Valve for Fuel Injection Equipments (Drawing 3)
2 Core Section
3 Electromagnetism -- Coil
4 Seal Member of Non-magnetic Material
5 Armature of Disk Mold
6 Needle Valve
7 Fuel Path
8 Return Spring
9 Terminal for Energization
10 Electromagnetism -- Bobbin of Coil 3
11 Electromagnetism -- Coil of Coil 3
12 Valve Seat
13 Nozzle
20 Solenoid Valve for Fuel Injection Equipments (Gestalt of 1st Operation, Drawing 1)
21 Core Section (Inside Core Section 23, 1st Outside Core Section 24, 2nd Outside Core Section 25)
22 Seal Member of Non-magnetic Material
22A The lower limit side of the seal member 22
23 Inside Core Section
23A The lower limit side of the inside core section 23
24 1st Outside Core Section
24A The step of the 1st outside core section 24
25 2nd Outside Core Section
25A The lower limit side of the 2nd outside core section 25
26 Ring-like Opening Space Section
27 Slight Opening Section between Lower Limit Side 23A of Inside Core Section 23 and Lower Limit Side 25A of 2nd Outside Core Section 25, and Armature 5
30 Fuel Injection Equipment (Drawing 2)
31 Solenoid Valve for Fuel Injection Equipments (Gestalt of 2nd Operation, Drawing 2)
32 Connector
33 Upper Part Bulb Housing (1st Outside Core Section 24)
34 Lower Part Bulb Housing
35 Fuel Feed Pipe
36 Spring Seat
37 Seal Member of Non-magnetic Material
38 1st Resilient Tongue of Seal Member 37

39 2nd Resilient Tongue of Seal Member 37
D The outer diameter of the seal member 22 (D<C)
C electromagnetism -- the outer diameter of a coil 3
W Thickness of the seal member 22

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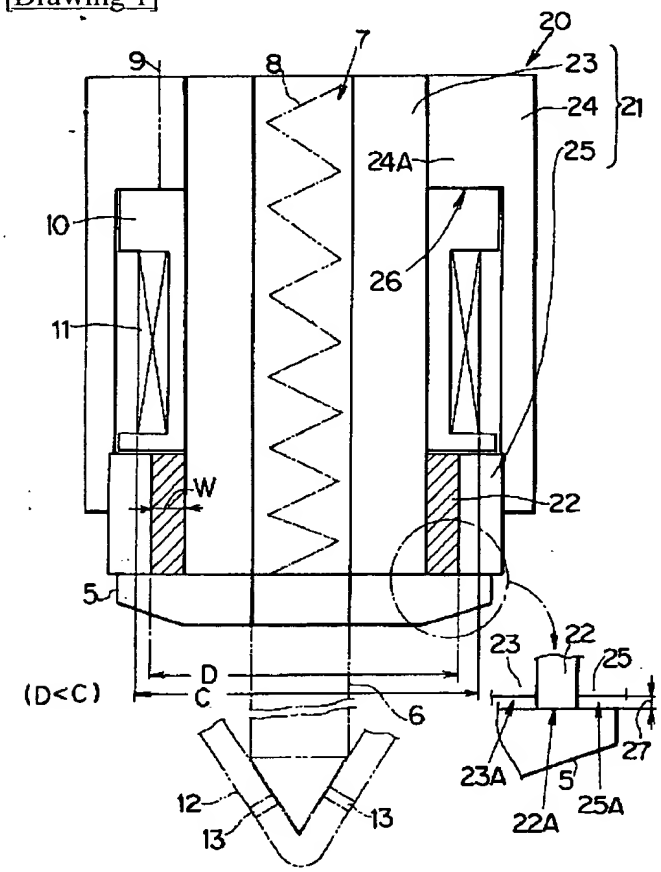
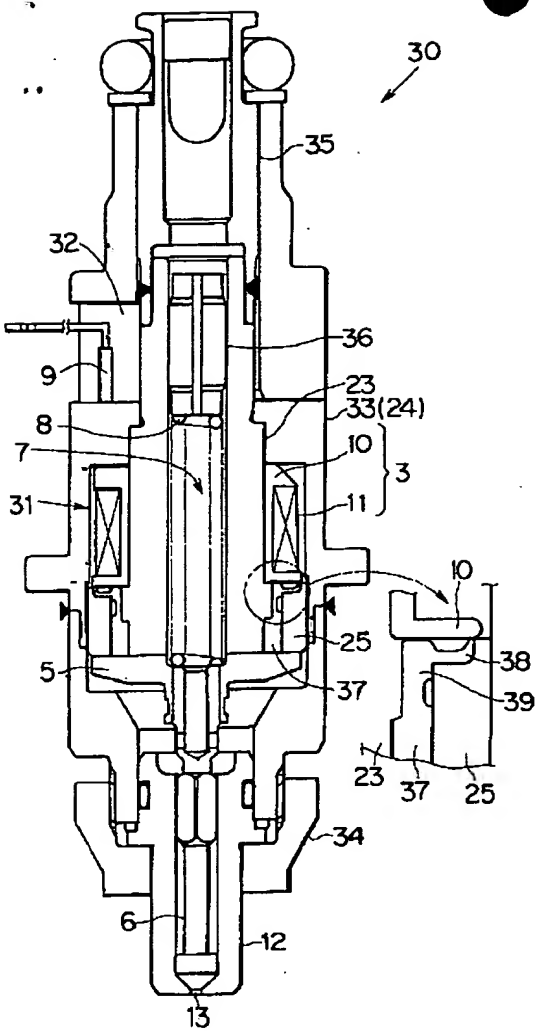
DRAWINGS

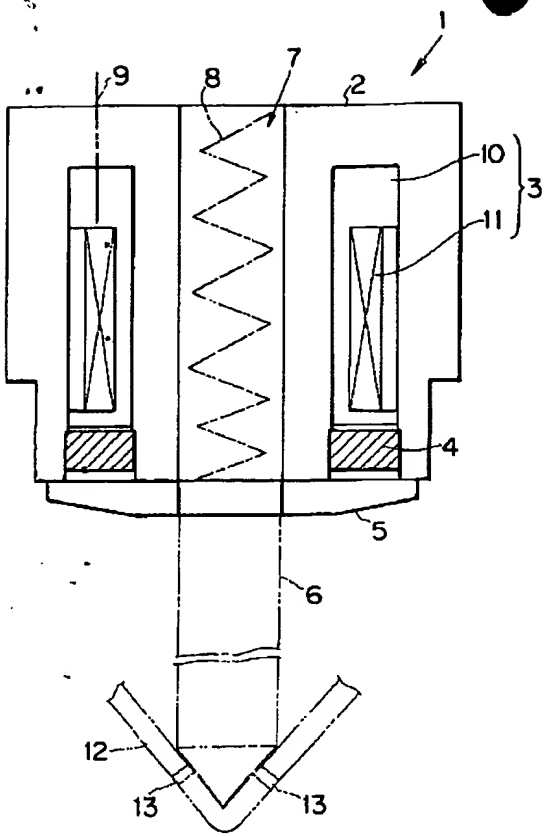
[Drawing 1]



[Drawing 2]



[Drawing 3]



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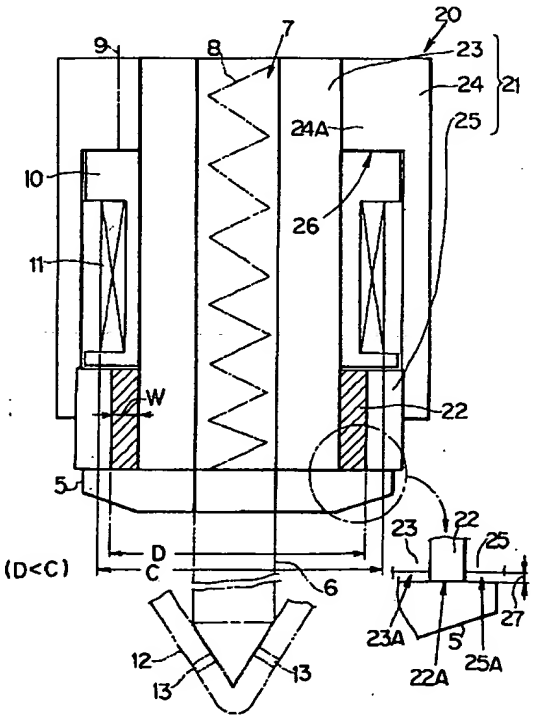
(54)【発明の名称】　燃料噴射装置用ソレノイドバルブ

(57)【要約】　（修正有）

【課題】　電磁コイル３の大きな吸引力および磁路面積を得ることができ、同一外径寸法で応答性の改善や作動可能燃料圧力の増加の要請に対応可能な燃料噴射装置用ソレノイドバルブを提供すること。

【解決手段】　シール部材２２が電磁コイル１１とアーマチャー５との間の磁路面積を縮小していること、この部分の磁路面積を拡大すれば同一の起磁力でも必要が吸引力を得ることが可能であることに着目したもので、コア部２１である内側コア部２３および外側コア部２４、２５の軸方向における、アーマチャー５側の一端にリング状に形成した開口空間部２６に電磁コイル１１、および非磁性体から構成したシール部材２２を設けて開口空間部２６を閉鎖し、さらにシール部材２２の外径Ｄは、電磁コイル３の外径Ｃよりこれを小さくしたことを特徴とする。



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【特許請求の範囲】

【請求項１】　磁性体から構成したコア部と、
このコア部に磁気回路を形成可能な電磁コイルと、
このコア部に吸着可能なディスク型のアーマチャーと、
このアーマチャーに取り付けるとともに、噴射孔から燃料を噴射可能とするニードル弁と、を有する燃料噴射装置用ソレノイドバルブであって、
前記コア部を、内側コア部および外側コア部から構成するとともに、
これら内側コア部および外側コア部の軸方向における、前記アーマチャー側の一端をリング状に開口して開口空間部を形成し、
この開口空間部に前記電磁コイルを設け、さらに非磁性体から構成したシール部材を設けてこの開口空間部を閉鎖し、かつこのシール部材の外径は、前記電磁コイルの外径よりこれを小さくしたことを特徴とする燃料噴射装置用ソレノイドバルブ。

【請求項２】　磁性体から構成したコア部と、
このコア部に磁気回路を形成可能な電磁コイルと、
このコア部に吸着可能なディスク型のアーマチャーと、
このアーマチャーに取り付けるとともに、噴射孔から燃料を噴射可能とするニードル弁と、を有する燃料噴射装置用ソレノイドバルブであって、
前記コア部を、内側コア部および外側コア部から構成するとともに、
これら内側コア部および外側コア部の軸方向における、前記アーマチャー側の一端をリング状に開口して開口空間部を形成し、
この開口空間部に、前記電磁コイルを設け、
この開口空間部の内周側に非磁性体から構成したシール部材を設け、さらにこの開口空間部の外周側に前記外側コア部を位置させることにより、この開口空間部を閉鎖したことを特徴とする燃料噴射装置用ソレノイドバルブ。

【請求項３】　前記内側コア部および前記外側コア部は、互いに別部材からこれを構成し、
この内側コア部は、これを中空円筒形状とし、
この外側コア部は、これをその内周面に前記開口空間部を形成可能な段差を有する中空円筒形状としたことを特徴とする請求項１あるいは２記載の燃料噴射装置用ソレノイドバルブ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は燃料噴射装置用ソレノイドバルブにかかるもので、とくに吸引力を大きく設定することができる燃料噴射装置用ソレノイドバルブに関するものである。

【０００２】

【従来の技術】従来のガソリン吸気管噴射用、あるいは高圧筒内直接噴射用の電磁式インジェクターなどの燃料

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噴射装置に用いられるソレノイドバルブのソレノイドに大きな吸引力が必要な場合には、プランジャ型のソレノイドより吸引面積を大きく設定することができるディスク型のソレノイドが一般に用いられている。すなわち、同一外径においてはディスク型のソレノイドの方がその吸引面積を大きく設定することができるので、発生吸引力を大きく取ることが可能である。したがって、高い応答性や高燃圧状態で作動が必要な場合に比較的容易に使用されている。たとえば、特開平８－１８９４３７号、特開平８－２１０２１７号などがある。しかしながら、このディスク型のソレノイドでも、限られたスペース内において得ることができる吸引力に限度があるという問題がある。

【０００３】図３にもとづき、従来の燃料噴射装置用ソレノイドバルブ１について概説する。図３は、燃料噴射装置用ソレノイドバルブ１の縦断面図であって、燃料噴射装置用ソレノイドバルブ１は、コア部２と、電磁コイル３と、シール部材４と、ディスク型のアーマチャー５と、ニードル弁６と、を有する。

【０００４】コア部２は、これを磁性体から構成し、電磁コイル３の内径側および外径側を囲んで磁束を通すもので、その中央部を燃料通路７とするとともに、リターンスプリング８を設置可能としてある。

【０００５】電磁コイル３は、通電用のターミナル９を取り付けたボビン１０と、通電により起磁力を発生させるコイル１１と、を有し、コア部２に磁気回路を形成可能である。

【０００６】シール部材４は、これを非磁性体から構成し、コア部２の内周側および外周側の磁路を遮断することにより、コア部２とアーマチャー５との間の磁路を確保し、燃料通路７側から電磁コイル３側に燃料が侵入しないようにシールするものである。

【０００７】アーマチャー５は、これを磁性体から構成し、コア部２との間に磁気回路を形成して電磁コイル３（コア部２）に吸着可能である。

【０００８】ニードル弁６は、アーマチャー５に取り付けるとともに、バルブシート１２の噴射孔１３から吸気管あるいはシリンダー内に直接燃料を噴射可能とする。

【０００９】なお、燃料噴射装置用ソレノイドバルブ１を組み立てるにあたっては、アーマチャー５側（図中下側）から電磁コイル３をコア部２に挿入し、さらにシール部材４をコア部２に圧入後、全周溶接を行う。

【００１０】こうした構成の燃料噴射装置用ソレノイドバルブ１において、電磁コイル３の励磁時におけるアーマチャー５を吸引するその吸引力Ｆは、$F=\phi^2/(\mu \cdot S \cdot \nu)$、から求められる。ただし、$\phi$は磁束量（Ｗｂ）、$\mu$は透磁率、Ｓは吸引部（コア部２がアーマチャー５と対向する、シール部材４を除いた部分）の面積、およびνは漏れ係数である。

【００１１】すなわち、燃料噴射装置用ソレノイドバル

ブ１の吸引力Ｆは、磁束量φにより決定される。一般的に磁性材料は、その飽和磁束密度が決まっているため、その磁束量φの最大値は、磁路断面積に比例する。要するに、磁路断面積を大きくした方が吸引力Ｆを大きくすることができるわけであるが、シール部材４がコア部２のアーマチャー５との対向する磁路断面積部分を大きく締めてしまっているため、すなわち、このシール部材４の部分が電磁コイル３によるアーマチャー５の吸引作用に寄与していないため、使用可能な吸引力Ｆおよび磁路面積が制限され、従来の燃料噴射装置用ソレノイドバルブ１においては磁路断面積をそれほど大きく取ることができず、吸引力Ｆを大きくすることが困難であるという問題がある。したがって、コア部２が同一外径寸法のままでは、燃料噴射装置用ソレノイドバルブ１として、さらなる応答性の改善や作動可能燃料圧力の増加を要求された場合に対応することができないという問題がある。

【００１２】こうした問題は、燃料噴射圧の高圧化、応答性の向上の要請などには障害となるもので、同一外径で吸引力Ｆを大きくすること、あるいはより小型の電磁コイル３で必要十分な吸引力Ｆを発生させること、などが要請されている。

【００１３】

【発明が解決しようとする課題】本発明は以上のような諸問題にかんがみなされたもので、従来よりも大きな吸引力を得ることが可能な燃料噴射装置用ソレノイドバルブを提供することを課題とする。

【００１４】また本発明は、従来よりも大きな磁路面積を得ることが可能な燃料噴射装置用ソレノイドバルブを提供することを課題とする。

【００１５】また本発明は、外径寸法の増加を行うことなしに、吸引力を大きく設定可能な燃料噴射装置用ソレノイドバルブを提供することを課題とする。

【００１６】また本発明は、同一外径寸法で応答性の改善や作動可能燃料圧力の増加の要請に対応可能な燃料噴射装置用ソレノイドバルブを提供することを課題とする。

【００１７】また本発明は、従来と同一スペースにおいて、電磁コイルの吸引力を増加し、高応答性や高燃料圧力状態での良好な作動性を実現可能な燃料噴射装置用ソレノイドバルブを提供することを課題とする。

【００１８】

【課題を解決するための手段】すなわち本発明は、シール部材が電磁コイルとアーマチャーとの間の磁路面積を縮小していること、この部分の磁路面積を拡大すれば同一の起磁力でも必要が吸引力を得ることが可能であることに着目したもので、第一の発明は、磁性体から構成したコア部と、このコア部に磁気回路を形成可能な電磁コイルと、このコア部に吸着可能なディスク型のアーマチャーと、このアーマチャーに取り付けるとともに、噴射孔から燃料を噴射可能とするニードル弁と、を有する燃料噴射装置用ソレノイドバルブであって、上記コア部を、内側コア部および外側コア部から構成するとともに、これら内側コア部および外側コア部の軸方向における、上記アーマチャー側の一端をリング状に開口して開口空間部を形成し、この開口空間部に上記電磁コイルを設け、さらに非磁性体から構成したシール部材を設けてこの開口空間部を閉鎖し、かつこのシール部材の外径は、上記電磁コイルの外径よりこれを小さくしたことを特徴とする燃料噴射装置用ソレノイドバルブである。

【００１９】第二の発明は、磁性体から構成したコア部と、このコア部に磁気回路を形成可能な電磁コイルと、このコア部に吸着可能なディスク型のアーマチャーと、このアーマチャーに取り付けるとともに、噴射孔から燃料を噴射可能とするニードル弁と、を有する燃料噴射装置用ソレノイドバルブであって、上記コア部を、内側コア部および外側コア部から構成するとともに、これら内側コア部および外側コア部の軸方向における、上記アーマチャー側の一端をリング状に開口して開口空間部を形成し、この開口空間部に、上記電磁コイルを設け、この開口空間部の内周側に非磁性体から構成したシール部材を設け、さらにこの開口空間部の外周側に上記外側コア部を位置させることにより、この開口空間部を閉鎖したことを特徴とする燃料噴射装置用ソレノイドバルブである。

【００２０】上記内側コア部および上記外側コア部は、互いに別部材からこれを構成し、この内側コア部は、これを中空円筒形状とし、この外側コア部は、これをその内周面に上記開口空間部を形成可能な段差を有する中空円筒形状とすることができる。

【００２１】上記シール部材には、そのシール性能を高めるための弾性舌片を形成することができる。

【００２２】さらに、コア部を内側コア部および外側コア部に分割して構成するための分割形態については、ソレノイドバルブとして組み立て可能で、かつ非磁性体のシール部材の断面積を小さくすることができれば、任意の構成を採用可能である。

【００２３】本発明による燃料噴射装置用ソレノイドバルブにおいては、シール部材が電磁コイルの部分への燃料侵入を防止するとともに磁路を確保し、このシール部材の断面積を小さくするようにしたので、電磁コイルとアーマチャーとの間の磁路面積をその分だけ大きくすることが可能となり、電磁コイルによるアーマチャーの吸引力を大きくすることができる。

【００２４】したがって、燃料噴射装置用ソレノイドバルブとして同一外径で、電磁コイルの吸引力を大きくすることができるとともに、必要十分な吸引力を得るために電磁コイルに通電する電流あるいはコイルの巻き数を減らして、昇圧値および立ち上がり速度を増加させ、電磁コイル自体の小型化が可能である。すなわち、磁路面積を大として、同じ吸引力を発生するために磁束密度を

低下させることができ、その分電磁コイルを小型化することができる。

【００２５】たとえば第一の発明では、シール部材の外径を電磁コイルの外径より小さくしたので、電磁コイルとアーマチャーとの間に磁束を多く発生することができ、電磁コイルによるアーマチャーの吸引力を増大可能である。

【００２６】さらに第二の発明では、シール部材より外周側にコア部を配置したので、このコア部にも磁束が通ってアーマチャーをより大きな吸引力で吸引することができる。

【００２７】また、シール部材の厚さを小さく設定し、内側および外側の磁路断面積をバランスよく配置すれば、吸引部分の面積は径の２乗となるため、より効果的に磁路断面積を増加させることができる。ただし、吸引に作用しない磁束の漏れも増加するため、シール部材の厚さには最適値が存在する。

【００２８】

【発明の実施の形態】つぎに、本発明の第１の実施の形態による燃料噴射装置用ソレノイドバルブ２０を図１にもとづき説明する。ただし、図３と同様の部分には同一符号を付し、その詳述はこれを省略する。図１は、燃料噴射装置用ソレノイドバルブ２０の縦断面図であって、燃料噴射装置用ソレノイドバルブ２０は、前記電磁コイル３、アーマチャー５およびニードル弁６とともに、コア部２に相当するコア部２１と、シール部材４に相当するシール部材２２と、を有する。コア部２１は、それぞれ中空円筒形状とした内側コア部２３、第１の外側コア部２４および第２の外側コア部２５を有する。内側コア部２３、第１の外側コア部２４および第２の外側コア部２５は、互いに別体ではあるが、これらをともに磁性体から構成し、磁束を通す。

【００２９】シール部材２２は、これを非磁性体から構成し、第２の外側コア部２５とともに電磁コイル３のボビン１０を支持している。

【００３０】すなわち、第１の外側コア部２４は段部２４Ａを有し、内側コア部２３および第１の外側コア部２４の間においてこの段部２４Ａとは反対側のアーマチャー５側に対向した一端にリング状に開口空間部２６を開口形成し、この開口空間部２６に電磁コイル３、さらにシール部材２２および第２の外側コア部２５を設けてある。換言すれば、コア部２１（内側コア部２３、第１の外側コア部２４および第２の外側コア部２５）のアーマチャー５側端面に内側コア部２３より大きな外径Ｄを有する円筒状のシール部材２２を設け、さらにその外側に強磁性体の第２の外側コア部２５が位置している。ただし、シール部材２２の外径Ｄは、電磁コイル３の外径Ｃより小さくしてある。これらの三つの部材は、プロジェクション溶接や圧入溶接などで一体に制作されている。

【００３１】なお、要部を拡大して示すように、シール部材２２のアーマチャー５側の下端面２２Ａを、内側コア部２３の下端面２３Ａおよび第２の外側コア部２５の下端面２５Ａよりわずかにアーマチャー５側に突出させてわずかな空隙部２７を設け、アーマチャー５が吸引されて図中上方にリフトしたときに非磁性体であるシール部材２２の下端面２２Ａのみにアーマチャー５が当接し、電磁コイル３の消磁時にリターンスプリング８の付勢力によってアーマチャー５が容易に図中下方に移動可能としてある。

【００３２】また、燃料噴射装置用ソレノイドバルブ２０を組み立てるにあたっては、シール部材２２、内側コア部２３および第２の外側コア部２５を一体状態として、内側コア部２３に電磁コイル３を図中上側から挿入する。さらに上側から第１の外側コア部２４を挿入し、内側コア部２３に圧入後、全周溶接を行って固定する。

【００３３】こうした構成の燃料噴射装置用ソレノイドバルブ２０において、シール部材２２の肉厚Ｗが小さいほど、全体が同一外径寸法でありながら、磁路および吸引部（第２の外側コア部２５および内側コア部２３）の断面積を大きく設定することができるため、その吸引力を増加させることができる。

【００３４】前記空隙部２７の磁路抵抗Ｒは、Ｒ＝１／（μ・Ｓ）、で表される。この吸引部の断面積Ｓが大きいと、この磁路抵抗Ｒが小さく、さらにコア部２１の磁束密度が低下するため、同一の吸引力Ｆを得るための起磁力を低下させても構わない。つまり、吸引力Ｆが増加することは、昇圧値が減少することであり、電磁コイル３のコイル１１に流す電流値あるいはその巻き数を減らすことができる。

【００３５】図２は、本発明の第２の実施の形態による燃料噴射装置用ソレノイドバルブを実際の燃料噴射装置３０に組み込んだ例を示す縦断面図であって、燃料噴射装置３０は、この燃料噴射装置用ソレノイドバルブ３１とともに、コネクター３２と、上方バルブハウジング３３（第１の外側コア部２４に相当）と、下方バルブハウジング３４と、燃料供給用パイプ３５と、スプリングシート３６と、前記バルブシート１２と、を有する。

【００３６】燃料噴射装置用ソレノイドバルブ３１は、コア部２１（内側コア部２３、第１の外側コア部２４、第２の外側コア部２５）、電磁コイル３、ディスク型のアーマチャー５およびニードル弁６とともに、シール部材４に相当するシール部材３７を有している。このシール部材３７は、要部を拡大して示すように、第２の外側コア部２５との間における半径方向の圧接部に第１の弾性舌片３８、および電磁コイル３のボビン１０との間における軸方向の圧接部に第２の弾性舌片３９を形成し、燃料のシール性能を向上させてある。

【００３７】こうした構成の燃料噴射装置用ソレノイドバルブ３１を装備した燃料噴射装置３０においても、図１にもとづいて説明した燃料噴射装置用ソレノイドバル

ブ２０と同様に、シール部材３７により燃料のシールを行うとともに、シール部材３７の半径方向の断面積を小さくしたので、その分電磁コイル３とアーマチャー５との間に形成される磁路面積を拡大し、電磁コイル３の吸引力を増加せさせることができる。

【００３８】

【発明の効果】以上のように本発明によれば、シール部材の大きさを小さくしたので、同一スペースで電磁コイルの吸引力を増加させることができる。また、磁路断面積が大きくなるため、同一吸引力時の起磁力を低下させることができる。さらに、燃料噴射装置としての応答性の改善および使用燃料圧力の上昇とともに、リターンスプリングのセット力を大きくすることができるので噴射量の調量範囲を増加することができる、などその性能を向上させることが可能となる。なおまた、燃料圧力を大きく設定することができれば、噴霧の微粒化を促進可能で、エンジンの燃焼および排気特性を改善することもできる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態による燃料噴射装置用ソレノイドバルブ２０の縦断面図である。

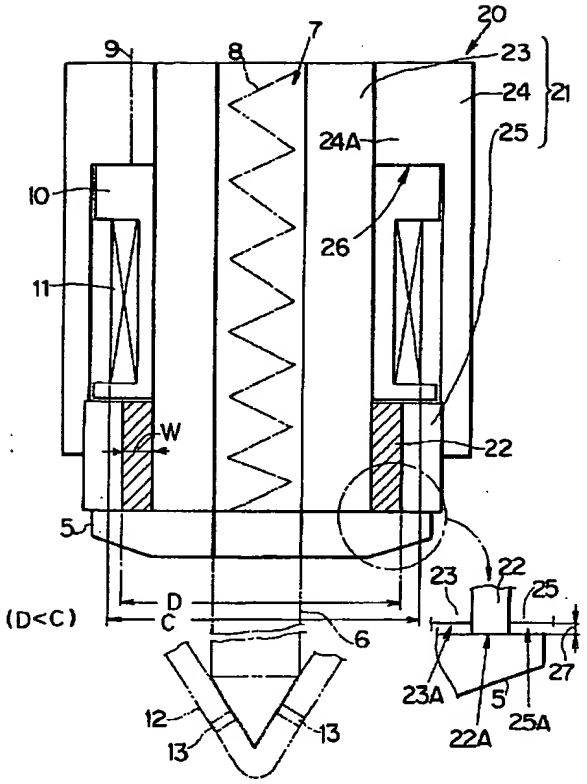
【図２】本発明の第２の実施の形態による燃料噴射装置用ソレノイドバルブ３１を実際の燃料噴射装置３０に組み込んだ例を示す縦断面図である。

【図３】従来の燃料噴射装置用ソレノイドバルブ１の縦断面図である。

【符号の説明】

1　燃料噴射装置用ソレノイドバルブ（図３）
2　コア部
3　電磁コイル
4　非磁性体のシール部材
5　ディスク型のアーマチャー
6　ニードル弁
7　燃料通路
8　リターンスプリング
9　通電用のターミナル
１０　電磁コイル３のボビン
１１　電磁コイル３のコイル
１２　バルブシート
１３　噴射孔
２０　燃料噴射装置用ソレノイドバルブ（第１の実施の形態、図１）
２１　コア部（内側コア部２３、第１の外側コア部２４、第２の外側コア部２５）
２２　非磁性体のシール部材
２２Ａ　シール部材２２の下端面
２３　内側コア部
２３Ａ　内側コア部２３の下端面
２４　第１の外側コア部
２４Ａ　第１の外側コア部２４の段部
２５　第２の外側コア部
２５Ａ　第２の外側コア部２５の下端面
２６　リング状の開口空間部
２７　内側コア部２３の下端面２３Ａおよび第２の外側コア部２５の下端面２５Ａとアーマチャー５との間のわずかな空隙部
３０　燃料噴射装置（図２）
３１　燃料噴射装置用ソレノイドバルブ（第２の実施の形態、図２）
３２　コネクター
３３　上方バルブハウジング（第１の外側コア部２４）
３４　下方バルブハウジング
３５　燃料供給パイプ
３６　スプリングシート
３７　非磁性体のシール部材
３８　シール部材３７の第１の弾性舌片
３９　シール部材３７の第２の弾性舌片
D　シール部材２２の外径（D＜C）
C　電磁コイル３の外径
W　シール部材２２の肉厚

【図１】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7
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21
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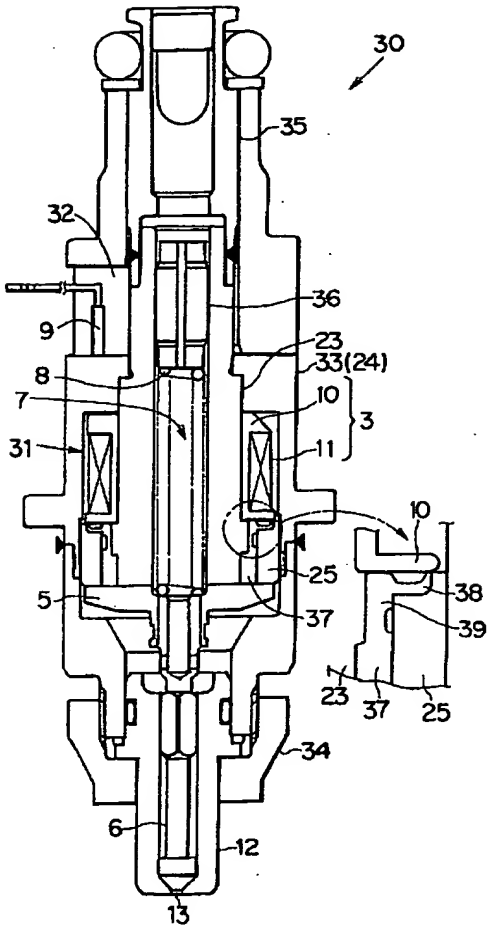
24A
10
26
11
W
22
5
23
22
25
D
(D<C)
C
6
27
23A
5
25A
22A
12
13
13

【図２】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35
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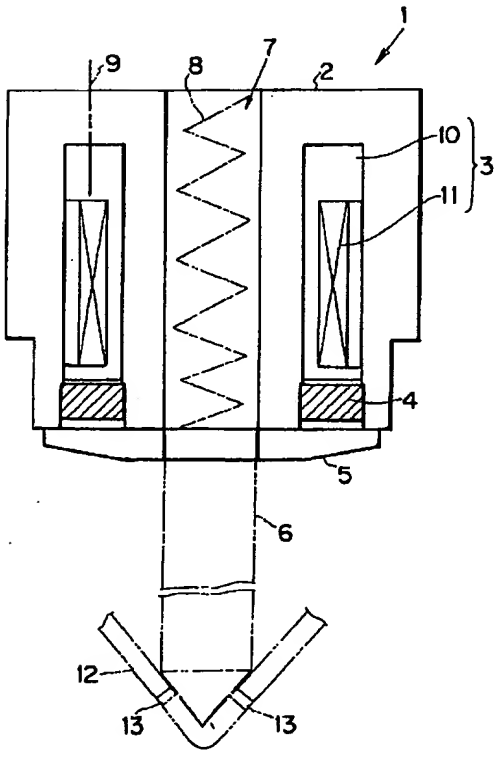
【図３】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